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value to publish in the MONTHLY Le Besque's method. He gives the following identity,

$$(\alpha^2+\beta^2+\gamma^2+\delta^2)^2 \equiv (\alpha^2+\beta^2-\gamma^2-\delta^2)^2+4(\alpha\gamma+\beta\delta)^2+4(\alpha\delta-\beta\gamma)^2.$$

Since every integral number n can be expressed in the form

$$n=\alpha^2+\beta^2+\gamma^2+\delta^2, \quad (\alpha, \beta, \gamma, \delta = 0, 1, 2, 3, \cdots)$$

this affords an easy and rapid means of finding integral sides for any integral diagonal n. Le Besque's identity needs certain restrictions which need not be stated here, on the form and relative size of α, β, γ, δ, to avoid duplication and results not relatively prime. If we put $\delta = 0$ it affords a still more rapid method of finding an indefinite number of solutions, although of course not all of them. For $\beta = \delta = 0$ it gives the well-known right triangle solutions, $\alpha^2+\gamma^2$, $\alpha^2-\gamma^2$, $4\alpha\gamma$.

FURTHER REMARKS BY HERBERT N. CARLETON, Newberry, Mass.

Mr. Martin's formula can be much simplified and brought to a form in which two numbers representing two of its sides can be directly derived.

Thus, let a, b, c be the three edges. Then since $(a+b)^2 \equiv a^2+2ab+b^2$, it is only necessary to choose a and b so that $2ab=\square$. When such values of a and b are determined, the third edge, $c=\sqrt{2ab}$, and we have

$$a^2+b^2+c^2=\square.$$

Since $2ab = a^2\cdot\dfrac{2b}{a}$, if $a^2=\dfrac{2b}{a}$, or $b=\frac{1}{2}a^3$, an integer, the conditions are fulfilled. From this it is seen that a^3 must be even and therefore a must be even.

Hence, by taking a equal to any even number, $b=\frac{1}{2}a^3$, and $c=\sqrt{2ab}$, we get numbers satisfying the conditions of the problem.

Note.—Each of these methods of solution has value and each satisfies the conditions of the problem, and none of them, it appears, will by any direct method include all possible solutions. Such a solution, so far as we know, does not exist. EDITORS.

420. Proposed by ELBERT H. CLARKE, Purdue University.

Given the infinite series,

$$\frac{a}{r}+\frac{b}{r^2}+\frac{a+b}{r^3}+\frac{a+2b}{r^4}+\frac{2a+3b}{r^5}+\cdots,$$

in which a and b are any numbers and where each numerator after the second is the sum of the two preceding numerators. To find the region of convergence and the sum of the series.

This problem is a generalization of one solved in the January (1914) number of the MONTHLY.

SOLUTION BY MRS. ELIZABETH B. DAVIS, U. S. Naval Observatory.

For $r \leqq 1$, the series is divergent. For $r>1$, the series is convergent. Let

$$S=\frac{a}{r}+\frac{b}{r^2}+\frac{a+b}{r^3}+\frac{a+2b}{r^4}+\cdots.$$

We have

$$\frac{a+b}{r^3}-\left(\frac{b}{r^2}\right)\cdot\frac{1}{r}-\left(\frac{a}{r}\right)\cdot\frac{1}{r^2}=0,$$

$$\frac{a+2b}{r^4}-\left(\frac{a+b}{r^3}\right)\cdot\frac{1}{r}-\left(\frac{b}{r^2}\right)\cdot\frac{1}{r^2}=0,$$

$$\cdot\quad\cdot\quad\cdot\quad\cdot\quad\cdot\quad\cdot\quad\cdot\quad\cdot\quad\cdot\quad\cdot\quad\cdot\quad\cdot\quad\cdot\quad\cdot\quad\cdot$$

Therefore, the scale of relation is $1-(1/r)-(1/r^2)$. Multiplying S successively by each term of the scale of relation, we have

$$S=\frac{a}{r}+\frac{b}{r^2}+\frac{a+b}{r^3}+\frac{a+2b}{r^4}+\cdots,$$

$$-\frac{1}{r}\cdot S=-\frac{a}{r^2}-\frac{b}{r^3}-\frac{a+b}{r^4}-\cdots,$$

$$-\frac{1}{r^2}\cdot S=-\frac{a}{r^3}-\frac{b}{r^4}-\cdots.$$

Adding, we have

$$\left(1-\frac{1}{r}-\frac{1}{r^2}\right)\cdot S=\frac{a}{r}+\frac{b-a}{r^2}.$$

Multiplying by r^2, we have

$$(r^2-r-1)\cdot S=a(r-1)+b.$$

Hence,

$$S=\frac{a(r-1)+b}{r(r-1)-1}.$$

Applying this formula to the special series solved in the January (1914) number of the MONTHLY, in that example

$$a=1,\qquad b=2,\qquad r=2,$$

and the scale of relation $=1-(1/2)-(1/4)$; whence

$$S=1+\frac{1(2-1)+2}{2(2-1)-1}=1+3=4.$$

GEOMETRY.

443. Proposed by CHARLES N. SCHMALL, New York City.

A quadrilateral of any shape whatever is divided by a transversal into two quadrilaterals. The diagonals of the original figure and those of the two resulting (smaller) figures are then drawn. Show that their three points of intersection are collinear.

II. SOLUTION BY VOLA BARTON, Goucher College.

Quadrilateral $AA'C'C$ is cut by line y. AC and $A'C'$ are cut by y in B and B', respectively. A, B, and C are collinear, and also A', B', and C', by hypothesis. These six points are so joined as to form the hexagon $AB'CA'BC'$.